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IX. *Observations to determine the amount of Atmospheric Refraction at Port Bowen in the Years 1824-25.* By Captain W. E. PARRY, R. N. F. R. S. Lieutenant HENRY FOSTER, R. N. F. R. S. and Lieutenant J. C. ROSS, R. N. F. L. S.

TO ascertain correctly by actual observation the amount of atmospherical refraction at low altitudes and at various states of the barometer and thermometer, is a problem which has long occupied the attention of practical astronomers; and many elaborate theories have also been given to explain the anomalies which have hitherto attended the most careful observations.

In Mr. IVORY's Paper, printed in the Philosophical Transactions for 1823, he states (page 495), that his table of refractions has been constructed merely with the view of comparing the theory in the paper with observation. He adds, however, " that it would be more satisfactory to determine " the same quantity ( $f$ ) by the comparison of many observed " refractions at low altitudes between the distances of 85 " and 88 degrees from the zenith; and by this means a " table might be constructed that would be deserving of " greater confidence."

With a view, therefore, to supply the desideratum alluded to, three distinct series of observations were made at Port Bowen, by Captain PARRY, Lieutenant FOSTER, and Lieutenant ROSS; the details of which are given in the following Paper.

Various methods suggested themselves for the determination of this question. The first was to measure the zenith distance of known stars at a given moment, with the repeat-

ing circle, and then to have computed the true altitude ; whence the actual refraction might have been deduced.

The difficulties, however, attending the use of the repeating circle, during the winter of the polar regions, have already been alluded to on several occasions, in the accounts of the two preceding voyages of discovery. The most material of these consist in the extreme contraction of the spirit in the long level, when filled in the usual way ; the instantaneous freezing of the breath or other vapour on the glasses, obliging the observer to hold his breath during each observation ; and the pain, amounting to the sensation, and producing the effects of burning consequent on touching intensely cold metal with the naked hand. The first of these was obviated, on the present occasion, by inserting a larger quantity of spirit than usual, so as to keep both ends of the bubble in sight, even during the most intense cold : this latter circumstance, however, afforded the opportunity of remarking an increased sluggishness in the level at very low temperatures, arising possibly from a certain degree of thickening in the spirit, which required the instrument to stand unmoved for at least two minutes after the contact had been made, in order to insure an accurate reading. It is unnecessary to point out, how unfavourable to minute accuracy this circumstance must prove, in observing an object having quick motion, either in altitude or in azimuth. A set of zenith distances, consisting of only eight observations, cannot, indeed, under such circumstances, be satisfactorily obtained in less than thirty-five or forty minutes. If to the difficulties already mentioned be added the annoyance sometimes experienced by the extinction of the lamp for illuminating the wires during an obser-

vation, in consequence of the freezing of the oil ; the frequent occurrence of snow drift ; and the haze which usually hangs near the horizon during a Polar winter, it must be admitted, that the repeating circle is not calculated, under such circumstances, either for obtaining numerous observations, or for ensuring the degree of accuracy indispensibly requisite in observations for determining the amount of atmospherical refractions.

Another method was suggested by Captain KATER, in April, 1824, which is explained in the following words :

“ Select a star which passes the zenith, and when this star  
“ and the Pole star are at the same altitude, take the distance  
“ between them by means of the repeating reflecting circle ;  
“ do the same when the star is in the zenith, and also when  
“ upon the meridian under the Pole. From the first observa-  
“ tions the true zenith distance of the stars may be readily  
“ obtained. By observations made when the star is in the  
“ zenith, the absolute refraction of the Pole star will be  
“ given, and from the observations made when the star is  
“ under the Pole, the refraction at that altitude can be easily  
“ deduced. Pursue the same method with other stars, care-  
“ fully marking at each observation the *time* and state of the  
“ *barometer* and *thermometer*. We shall thus be furnished with  
“ data, from which the refraction at the various altitudes can  
“ be computed with facility and accuracy.”

On considering, however, the difficulties already detailed in the use of the repeating circle, which rendered it impossible to take advantage of this ingenious suggestion of Captain KATER ; it occurred to Lieutenant FOSTER, that a more simple and accurate method of determining the amount of refraction,

would be to observe the setting of stars within certain limits of azimuth, behind the high land which encircles this harbour, and then determining at leisure the zenith distance of that part behind which the star set. As the ruggedness of the land, however, combined with the frequent alteration of the star's azimuth, would materially affect results thus obtained; Captain PARRY proposed, as a modification of this idea, to place a board edge-wise, and strictly horizontal, on the spot behind which the star set, thus rendering it unimportant upon what part of the board the occultation of the object took place, as well as affording more ready means of obtaining its apparent altitude.

Two boards were accordingly fixed with all possible firmness and accuracy upon a neighbouring hill, to the westward of the observatory, for observing the setting of  $\alpha$  Aquilæ and Arcturus respectively, the board for the former being on a N  $75^{\circ}\frac{1}{2}$  W bearing, distant 924 feet, and for the latter N  $40^{\circ}$  W, 1590 feet.

The observations by Captain PARRY, given in Tables II. and VI., were made with a small theodolite, having its legs immoveably fixed by freezing, across a cask filled with sand; those in Table IV. by a ship telescope, two feet in length, securely attached to the cask itself, and having no motion whatever.

Lieutenant FOSTER's observations contained in Tables VIII. to XI. inclusive, were made with a small repeating circle by DOLLOND, furnished with two telescopes, which afforded the means of obtaining double observations of each star the same evening. This instrument stood 122 feet above the level of the sea, on a cask filled with sand, firmly frozen to the ground, and was secured from the weather by a suitable covering.

The observations by Lieutenant Ross, in Tables XIII. to XV. inclusive, were obtained with a small variation transit instrument as an upper telescope, and those in Tables XVI. and XVII. by a pocket telescope below ; both being fixed to a cask filled with sand. None of the instruments used by either of the three observers were removed, till after the completion of the whole series of observations.

The hour angle by which the true altitude of the setting star was determined, was obtained by taking its right ascension from that of the meridian, at the time of observation, as found by transits of well known stars, which took place within three quarters of an hour of the other star's setting, thus rendering the observations as independent as possible of any want of uniformity in the rates of the pocket chronometers employed by the observers. The transits were taken exclusively by Lieutenant FOSTER, and comparisons with the chronometer he employed, were taken by the other observers about the time of transit, in order to deduce their horary angles, contained in the respective Tables. The position of the transit instrument was rigidly verified by the transits of high and low stars in their passages across the meridian, as well as by a constant reference to a meridian mark, and by the most minute attention to the level. The heights of the barometer, and of the thermometer, suspended with its bulb on the same level with the observers in the open air, were taken at the time of every observation. The registered height of the barometer, however, in the Tables, has been corrected for instrumental errors, and brought up to a certain temperature, which is specified at the head of each of the columns containing it.

The latitude,  $73^{\circ} 13' 39''.4$  N.\* used in these computations, is the result of 91 sets of observations on Polaris, at different horary distances from the north and south meridians, by Captain PARRY and Lieutenant FOSTER; employing Dr. YOUNG's Table of Atmospherical Refractions, published at the end of the Nautical Almanack for each year.

As soon as the sun afforded sufficient light for obtaining the apparent altitudes of the boards from the respective telescopes, observations were commenced for that purpose. The circle used by Lieutenant FOSTER afforded the direct means of doing this, for the upper telescope, by which the zenith distance of the edge of the board at the spot where the star set, was at once obtained by observation. The angular distance between this telescope and the lower one, as seen from the board, was determined by means of a double wire micrometer, attached to one of DOLLOND's achromatic telescopes 46 inches focal length, the object-glass of which was let into the board, so as to make its centre exactly coincide with that part behind which the star set.

The telescopes employed by Captain PARRY and Lieutenant Ross, not being attached to an instrument calculated for measuring zenith distances, required some further contrivance to obtain the altitudes of the boards with respect to them. In order to place the repeating circle precisely at the same altitude with Captain PARRY's upper telescope, a levelling staff was fixed into the ground, half way between the place of observation and the board. This being adjusted by sliding up or down till a fine brass point on its upper end exactly

\* The elements of this result, are given in the Appendix to Capt. PARRY's Narrative of the Third Voyage for the Discovery of a North West Passage into the Pacific Ocean.

coincided with the edge of the board, when seen through the upper telescope; the repeating circle was also raised or lowered until the same coincidence obtained, when looking through *its* telescope. The accuracy of the position thus obtained was finally verified by observing the setting of the star, through each telescope, when it was found to disappear to both observers at the same instant.

For the altitude of the board, with respect to the lower telescope used by Captain PARRY, a short staff, exactly equal in length to the measured distance between the telescopes, was fixed vertically above the board, and the zenith distance of its well defined top observed by the repeating circle in its former place. And as a confirmation of the results thus obtained, the method described above, as adopted by Lieutenant FOSTER, by means of the micrometer, was also resorted to; a mean of the two methods (which differed  $2''.8$ ), being used in the computation of the refractions. Lieutenant Ross's zenith distances were obtained by a repeating circle, placed on the same cask which held the telescopes he employed, the angular distance between each of these, and that of the circle (when directed to the board), being determined by repeated observations with the micrometer, fixed upon the respective boards in the manner already described. In some instances, Lieutenant Ross observed the re-appearance of  $\alpha$  Aquilæ under the board, thus obtaining an observation at another altitude. The corresponding zenith distance of that part of the board was determined by measuring with the micrometer, the angle subtended by the board at the place of observation.

The zenith distances of the boards, as obtained by the



respective observers, are given in the Tables attached to the corresponding observations for refraction, except those of Lieutenant Ross, the details of which, were unfortunately left on board the *Fury* at the time of her loss.

While making the above mentioned observations for the zenith-distances of the boards, Captain PARRY had occasion to notice, on the 28th of February, some anomalies which had never before occurred, and which were at first attributed to some slight and imperceptible change in the position of the repeating circle (see Table III.) On-continuing the observations, however, it soon appeared that the changes coincided nearly with particular times of the day, the greatest zenith distance always occurring when the thermometer stood the highest, and the weather was most calm. To clear the zenith distances of this effect of refraction, the repeating circle was carried up the hill, the object-glass of its telescope being placed in a notch cut in the board, as already described above in using the micrometer ; when by several days' observations, continued from morning till night, it was found that the same phenomenon as before occurred, the zenith distance of the station below uniformly increasing from the morning till the afternoon, and again decreasing as the sun fell. Two sets of observations taken at the board after midnight, by means of a lamp viewed through the tube of the telescope, at the lower station, gave nearly a mean of all the other observations. Thus it appeared that whether observed from the top or the bottom of a hill whose altitude was  $4^{\circ}\frac{1}{2}$ , an increase of zenith distance (varying from 9" to 17"), took place about the same hours, indicating a comparatively rare medium near the surface of the ground, and giving such a curvature to the visual ray, as to produce a similar effect at both stations.

Table I.  
Observations for determining the Apparent Altitude of Arcturus at Setting, by Captain PARRY, 1824-5.

The corresponding Observations for Refraction are contained in Table II.

Day.	Time.	No. of Ob- serva- tions.	Mean Reading of the four Verniers.		Correction for		Apparent Altitude.	Barom. Corr. to Temp. + 50°	Temp. Fahr.	Velocity of Winds.	Weather.	Remarks.
			Index.	Level.								
1825. Mar. 23rd	6 <sup>h</sup> to 6 <sup>h</sup> 40 <sup>m</sup> A. M.	8	299 45 55	+10	—	18.75	0' 1" 46.72	Inches. 30.353	—36.5	Lt. variable	Very clear &	☉ not risen.
	7 <sup>h</sup> to 7 <sup>h</sup> 40 <sup>m</sup> A. M.	8	239 31 43	*	—	13.75	48.22	.....	—35	Airs	Fine	☉ not on the instrument.
	9 <sup>h</sup> 10 <sup>m</sup> to 10 <sup>h</sup> A. M.	8	179 17 22.5	*	+	9.75	46.34	30.348	—31	Ditto	Ditto	☉ on the instrument.
	Noon to 0 <sup>h</sup> 40 <sup>m</sup> P. M.	8	299 47 18.75	+13	+	29.75	37.25	30.349	{ —25 in ☉ —16 }	Ditto	Ditto	Ditto.
Mar. 24th	1 <sup>h</sup> 15 <sup>m</sup> to 2 <sup>h</sup> 30 <sup>m</sup> P. M.	8	239 33 44.5	*	+1	29	30.66	.....	{ —26 ☉ —12 }	Ditto	Ditto	Do. some waving at the board.
	3 <sup>h</sup> 10 <sup>m</sup> to 4 <sup>h</sup> P. M.	8	299 46 52.5	+10	+	8.25	36.16	30.343	—27	Ditto	Ditto	Ditto
	4 <sup>h</sup> 40 <sup>m</sup> to 5 <sup>h</sup> 15 <sup>m</sup> P. M.	8	239 34 10	*	—	23.75	38.28	30.330	—30	Ditto	Ditto	Instrument partly shaded.
	5 <sup>h</sup> 30 <sup>m</sup> to 6 <sup>h</sup> 10 <sup>m</sup> P. M.	8	299 46 55	+10	—	9.5	38.06	.....	—31	Ditto	Ditto	Ditto quite shaded.
	6 <sup>h</sup> 20 <sup>m</sup> to 6 <sup>h</sup> 55 <sup>m</sup> A. M.	8	299 45 57.5	+10	+	18.25	41.78	30.355	—37	Light air	Clear & fine	☉ not risen.
	1 <sup>h</sup> 15 <sup>m</sup> to 2 <sup>h</sup> P. M.	8	299 47 15	+10	+	21.5	31.69	30.386	{ —28 ☉ —15 }	Easterly	Ditto	Instrument skreened from ☉.
	2 <sup>h</sup> 10 <sup>m</sup> to 2 <sup>h</sup> 40 <sup>m</sup> P. M.	8	239 33 54	*	+	48.75	34.03	.....	{ —29 ☉ —19½ }	Ditto	Ditto	Ditto by a snow wall.
	4 <sup>h</sup> 30 <sup>m</sup> to 5 <sup>h</sup> 30 <sup>m</sup> P. M.	8	299 47 27.5	+5	—	22	36.19	30.380	—32	Ditto	Ditto	Ditto
Mar. 25th	4 <sup>h</sup> 30 <sup>m</sup> to 5 <sup>h</sup> 30 <sup>m</sup> P. M.	8	299 46 37.5	+10	—	30.25	42.84	30.397	—38.5	Light airs	Fine & clear	{ The instrument quite shaded by a wall of snow.
	6 <sup>h</sup> 10 <sup>m</sup> to 6 <sup>h</sup> 50 <sup>m</sup> A. M.	8	299 45 42.75	+10	+1	00.75	38.31	30.396	—32	Ditto	Ditto	
	1 <sup>h</sup> to 1 <sup>h</sup> 40 <sup>m</sup> P. M.	8	299 45 42.75	*	+	12.75	35.53	30.387	—30	Ditto	Ditto	
	2 <sup>h</sup> to 2 <sup>h</sup> 40 <sup>m</sup> P. M.	8	239 32 45.75	*	—	13.75	44.63	30.393	—32	Ditto	Ditto	
Apr. 2nd	5 <sup>h</sup> 15 <sup>m</sup> to 6 <sup>h</sup> 15 <sup>m</sup> P. M.	8	179 19 02.5	*	—	24.5	44.44	29.938	—35	Wind	Clear	☉ not risen.
	4 <sup>h</sup> 40 <sup>m</sup> to 5 <sup>h</sup> 20 <sup>m</sup> A. M.	8	299 46 21.5	+7.5	—	19.75	37.94	29.889	{ —23 ☉ —20 }	Fresh and Cold	Ditto	Instrument skreened from ☉.
	1 <sup>h</sup> 30 <sup>m</sup> to 2 <sup>h</sup> 15 <sup>m</sup> P. M.	8	299 47 08.75	+7.5	—	7	36.03	29.881	—23	Ditto	Ditto	Ditto.
	2 <sup>h</sup> 30 <sup>m</sup> to 3 <sup>h</sup> 10 <sup>m</sup> P. M.	8	239 34 27.5	*	—	12	33.22	29.875	—28	Ditto	Ditto	☉ on instrument.
Apr. 6th.	2 <sup>h</sup> to 2 <sup>h</sup> 40 <sup>m</sup> P. M.	8	299 47 37.5	+7.5	—	7	32.75	30.104	{ —22 ☉ —16 }	Light	Ditto	Ditto

Mean apparent altitude 7° 31' 38", 62 used for the refractions in Table II.

\* The index not reset to 360°.

Table II.  
Observations for the Atmospheric Refraction observed by the setting of Arcturus, 1824-5, by Captain PARRY.

Apparent Altitude  $7^{\circ} 31' 38''.62$ .

Day.	Time of Arcturus setting by No. 2.		Transit Observed.		Rate of losing.	Arcturus's			Observed Refraction.	Barom. Corr. to Temp. + 50°	Temp. Fahr.	Winds.	Weather.	Remarks.
	h. m. s.	h. m. s.	Time reduced to No. 2.	Star.		h. m. s.	Horary $\angle$ at setting.	True altitude.						
1824.														
Nov. 28th	0 33 45.3	1 14 48.08		$\alpha$ Andromeda	1,0	9 10 32,82	7 23 50,3	7 48,32	29,936	Inches.	0	Easterly Fresh	Very Clear	
Dec. 1st	0 22 01	3 00 37.54		$\alpha$ Arietis	1,0	9 10 38,21	7 23 34,7	8 03,92	30,083		5	Ditto	Ditto	
2d	0 26 49.5	3 05 23.34		Ditto	1,24	9 10 40,85	7 23 27,4	8 11,22	29,946		21	Ditto	Ditto	
5th	0 14 59.2	0 55 51.86		$\alpha$ Andromeda	1,24	9 10 43,20	7 23 21,5	8 16,87	939		21	Ditto	Ditto	
6th	0 10 59.2	0 51 54.91		Ditto	1,24	9 10 39,69	7 23 29,2	8 09,42	786		18,8	Ditto	Ditto	A few fleecy clouds, star clear.
7th	0 07 01	0 47 57.95		Ditto	1,24	9 10 38,42	7 23 32,5	8 06,12	517		11	NNE Fresh	Very clear	
8th	0 03 05	0 44 00.85		Ditto	1,24	9 10 39,53	7 23 29,2	8 09,42	501		19,5	NE Light	Ditto	
9th	11 59 10	12 40 03.36		Ditto	1,24	9 10 41,85	7 23 22,5	8 16,12	719		18,5	NNE Ditto	Ditto	
10th	11 55 04	12 36 07.5		Ditto	2,22	9 10 31,64	7 23 50,2	7 48,42	683		11,5	Ditto Fresh	Rather hazy near horizon.	
11th	11 51 10	12 32 08.26		Ditto	2,22	9 10 36,86	7 23 35,8	8 02,82	610		15,2	NW Fresh	Clear	
13th	11 43 18,2	12 24 11,9		Ditto	2,22	9 10 41,32	7 23 22,8	8 15,82	30,001		24,5	WNW Ditto	Very clear	
14th	11 39 24	12 20 13,9		Ditto	2,22	9 10 45,09	7 23 08,6	8 30,02	152		27,2	NE Light	Ditto	
15th	11 35 30,5	12 16 15,13		Ditto	2,22	9 10 50,35	7 23 57,5	8 41,12	337		35	North Fresh	Ditto	[South.
20th	11 15 27	13 54 04.46		$\alpha$ Arietis	1,97	9 10 36,6	7 23 34,3	8 04,32	29,619		23,5	Ditto except near horizon.	Aurora in	
21st	11 11 37	11 52 27.45		$\alpha$ Andromeda	1,97	9 10 44,28	7 23 12,8	8 25,82	807		28,2	Ditto Light	Clear	Aurora faint S.W.
22d	11 07 38	11 48 29.96		Ditto	1,97	9 10 47,68	7 23 16,9	8 21,72	877		29	Easterly Ditto	Ditto	Ditto
23d	11 03 47	11 44 33.96		Ditto	1,97	9 10 47,68	7 23 03	8 35,62	801		31	Calm	Ditto	Star not very distinct.
26th	10 51 48,5	11 32 43.13		Ditto	0,73	9 10 39,91	7 23 33,6	8 15,02	989		27,8	ENE moderate	Ditto	Aurora faint S.S.W.
29th	10 39 56	11 20 52.75		Ditto	0,73	9 10 37,71	7 23 21,6	8 17,02	637		16,5	East Light	Very Clear	
1825.														
Jan. 2d	10 23 59	11 04 51.95		Ditto	3,25	9 10 41,17	7 23 18,5	8 20,12	881		29,4	Ditto Ditto	Clear	Star quite clear.
3d	10 20 03	12 58 34.5		$\alpha$ Arietis	3,25	9 10 41,88	7 23 15,5	8 23,12	835		31,7	Ditto Ditto	A few thin clouds.	Star distinct.
4th	10 15 59	10 56 56.62		$\alpha$ Andromeda	3,25	9 10 36,39	7 23 30,25	8 08,37	487		27	ENE Squally	Some haze	Indifferent observation.
5th	10 12 05,5	10 52 59.63		Ditto	3,25	9 10 39,86	7 23 20,6	8 18,02	338		36,5	Easterly Light	Ditto	Star distinct.
6th	10 08 13	10 49 01,7		Ditto	3,25	9 10 45,88	7 23 03,6	8 35,02	269		32,2	Northerly D.	Tolerably Clear	
7th	10 04 12,5	10 45 04,1		Ditto	2,11	9 10 42,33	7 23 13,4	8 24,22	529		35,5	Easterly Ditto	Quite Clear	
10th	9 52 20	10 33 10.43		Ditto	2,11	9 10 43,48	7 23 46,7	8 51,92	962		35,5	Ditto Ditto	Very Clear	
11th	9 48 26	10 29 13.25		Ditto	2,11	9 10 46,53	7 23 00,7	8 37,92	30,140		38,3	Ditto Ditto	Ditto	
12th	9 44 26,5	10 25 14.23		Ditto	2,11	9 10 46	7 23 02	8 36,62	29,954		38,4	ENE Ditto	Ditto	
15th	9 32 32	10 13 20.85		Ditto	2,5	9 10 44,75	7 23 05,2	8 33,42	711		27,5	Easterly Ditto	Ditto	Some twilight westward.
16th	9 28 29,5	10 09 20.78		Ditto	2,5	9 10 42,27	7 23 11,7	8 26,92	730		31,2	Ditto Ditto	Ditto	Star distinct, good obser <sup>a</sup> .
17th	9 24 30,6	10 05 19,71		Ditto	2,5	9 10 44,39	7 23 05,8	8 32,82	638		28	Ditto Mod.	Rather hazy	Star quite distinct.
24th	8 13 12	8 53 54.56		Ditto	6,02	9 10 50,55	7 23 47,4	8 51,22	822		37,2	NEast. Light	Tolerably Clear	Star quite distinct.
25th	8 09 06	7 46 45.57		$\alpha$ Pegasi	6,02	9 10 45,24	7 23 01,8	8 36,82	795		42,2	Ditto Ditto	Very Clear	Strong twilight westward.
27th	8 00 55,5	7 38 42,5		Ditto	6,02	9 10 37,74	7 23 20,1	8 18,52	846		27	NW Fresh	Clear and Drift	Star quite clear.
Means										29,791	— 23,58			

Table III.

Observations for determining the apparent altitude of  $\alpha$  Aquilæ at setting, by Captain PARRY's upper telescope. The corresponding observations for refraction are contained in Table IV.

Day.	Time.	No. of Observations.	Mean Reading of the four Verniers.	Correction for		Apparent Altitude.	Barom. Corr. to Temp. + 50°.	Temp. in Shade Fahr.	Winds True.	Weather.	Remarks.	
				Index.	Level.							
1825.	<sup>h</sup> <sup>m</sup>		<sup>o</sup> <sup>'</sup> <sup>"</sup>	<sup>"</sup>	<sup>"</sup>	<sup>o</sup> <sup>'</sup> <sup>"</sup>	Inches.	<sup>o</sup>				
Feb. 2d	{ 10 30 A. M.	8	323 40 12,5	+10	— 2,25	4 32 27,47	30,04	—39,5	Easterly }	Very clear	The sun did not rise upon the board till the 12th, nor on the place of observation till the 14th.	
	{ to 2 P. M.	8	323 41 10	+10	—34,5	24,31	....	—40,5	very light }			
5th	11 to Noon.	8	323 41 07,5	+10	—40,5	25,37	29,05	—26	NNE Fresh	Clear & fine		
11th	1 to 2 P. M.	8	323 40 15	+ 7,5	+21,5	24,53	30,15	—31,5	Easterly Light			
15th	Noon to 1 P. M.	8	323 40 30	+11,25	— 8	25,84	29,65	—31,5	Northerly Light	Hazy		
28th	10 30 to 11 30 A. M.	8	323 37 53,25	+ 7,5	+40,5	39,84	29,90	—18	{ Easterly very light }	Clear and warm		
	0 to 0 40 P. M.	8	287 18 17,5	*	—108,25	35,5	....	—19				
	0 45 to 1 30 P. M.	8	250 56 35,75	*	+24,75	39,62	....	—19				
	1 25 to 2 15 P. M.	8	214 36 37,5	*	— 8	30,78	....	—18,5				
	about sunset.	8	178 16 32,5	*	—11,75	32,04	29,93	—19				
Mean of observations at lower station						4 32 30,53						
All the following observations were made at the upper station.												
Mar 7th	{ <sup>h</sup> <sup>m</sup> 10 30 A. M.	20	90 54 40	+10	+10,25	4 32 45,01	30,19	—35	Varia. & Light	Clear	Sun bright and very warm.	
	{ to 0 40 P. M.											
8th	{ 10 A. M. to Noon.	20	90 51 57,5	0	—1'47,75	30,49	29,98	—27	Easterly Light	Cloudy		
	{ 0 to 2 P. M.	20	181 46 12,5	*	—1'26,25	38,44	....	—27	.....	☉ breaking through the clouds.		
	{ 2 to 4 30 P. M.	20	272 36 48,75	*	—50,75	29,27	30,00	—28,5	.....	☉ obscured		
	{ 11 A. M. to 0 30 P. M.	10	225 24 34,25	+10	+27,25	31,13	30,26	—28	Nearly calm weather	Very clear		
10th	{ 0 46 to 1 50 P. M.	10	90 50 13,75	*	+1'20	41,95	....	—29	Ditto	Ditto		
	{ 2 to 2 55 P. M.	10	316 14 29,25	*	+1'16,25	33,17	30,28	—29		Ditto		
	{ 3 10 to 4 15 P. M.	10	181 40 17,5	*	—32	31,62	....	—30	Ditto	Ditto		
	{ 4 15 to 5 40 P. M.	6	28 54 32,5	*	+29	27,33	30,30	—30,5		Ditto		
	{ 6 30 to 7 40 A. M.	10	225 23 17,5	+ 6,2	+18,25	22,19	30,37	—37	Fine and nearly calm throughout the day	Ditto		
	{ 7 50 to 8 40 A. M.	8	261 43 03,75	*	+ 9	29,41	30,38	—35				
11th	{ 9 45 to 10 40 A. M.	10	225 23 42,5	+10	+31	26,35	....	—34	Ditto	Ditto		
	{ Noon to 1 P. M.	10	† 67 39 58,75	*	+22,25	31,35	30,39	—29				
	{ 1 25 to 2 30 P. M.	10	293 05 15	*	+26,25	34,25	30,34	—28	Ditto	Ditto		
	{ 3 10 to 4 P. M.	8	36 20 58,75	+12,5	—30,25	35,13	....	—29				
	{ 4 50 to 5 30 P. M.	10	† 64 26 32,5	*	—35,25	26,22	30,35	—33	Ditto	Ditto		
	{ 6 30 to 7 30 A. M.	10	225 24 38,75	+ 7,5	—25,75	26,05	30,20	—35,5				
12th	{ 11 45 to 0 35 P. M.	10	225 25 30	+ 6,5	+28,25	36,47	30,12	—27	Ditto	Ditto		
	{ 2 50 to 3 30 P. M.	10	†† 67 44 05	*	+59,5	39,20	30,05	—27,5				
	{ 4 10 to 4 50 P. M.	10	†† 95 51 17,5	*	—55	33,75	30,02	—31	Ditto	Ditto		
	{ 6 15 to 7 15 A. M.	8	36 19 50	+ 6,2	—71,5	20,59	29,79	—35				
14th	{ 1 30 to 2 30 P. M.	10	202 19 05,5	* *	+ 7	37,80	75	—26,5	Ditto	Ditto		
	{ 4 20 to 5 40 P. M.	12	54 29 51,25	+ 7,5	—45,5	26,10	76	—30				
21st	10 40 to 11 50 P. M.	8	36 21 17,5	+10	—58,75	33,59	29,90	—33	Calm	Very clear		
22d	0 till 1 A. M.	8	72 42 12,5	*	— 3,25	36,47	....	—35				
Mean of 2 sets taken at night at the upper station						4 32 35,03						

\* Index not reset to 360° after the last observation.  
† Index not reset after an observation for another object. Index error 202° 15' 07",5.  
† Ditto - - - - - 199 01 35.  
†† Ditto - - - - - 202 18 32,5.  
††† Ditto - - - - - 230 24 45.  
\*\* Ditto - - - - - 336 52 54,5.

		Altitude.	
Mean of 80 zenith distances taken at the lower station		<sup>o</sup> <sup>'</sup> <sup>"</sup>	4 32 30,35
Mean of 278 at the upper station	-	-	4 32 32,13
Mean of both stations by day	-	-	4 32 31,67
Mean of 16 zenith distances taken at night	-	-	4 32 35,03
Mean of all the above	-	-	4 32 32,34 used in computing the refractions in Table IV.

Table IV.

Observations for the Atmospheric Refraction observed by the setting of  $\alpha$  Aquilæ 1824-5, by Captain PARRY.Apparent Altitude  $4^{\circ} 32' 34''$ .

Day.	Time of $\alpha$ Aquilæ setting by No. 2.		Transit Observed.		Rate of No. 2. Losing.	$\alpha$ Aquilæ.			Observed Refraction.	Barom. Corr. to $+50^{\circ}$ .	Temp. Fahr.	Winds True.	Weather.	Remarks, &c.
	h. m. s.	h. m. s.	Time reduced to No. 2.	Star.		h. m. s.	$\angle$ Hourly at setting.	True Altitude.						
1824.														
Dec. 8th	3 18 48.5	2 41 40.38	1 24	$\alpha$ Arietis	s.	6 52 21.35	4 19 44.8	12 47.54	29.544	Inches.	-18	NNE Fresh	Very Clear	
10th	3 10 48	0 36 07.55	2,22	$\alpha$ Andromedæ	2,22	6 52 14.45	20 10.8	12 21.54	564		14	Northerly Light	Ditto	
11th	3 06 51	2 29 48.2	2,22	$\alpha$ Arietis	2,22	6 52 16.05	20 05.5	12 26.84	707		14	NNW Fresh	Clear	
13th	2 59 06.5	2 21 51.23	2,22	Ditto	2,22	6 52 28.54	19 13	13 19.34	30,056		25	North Light	Very Clear	
16th	2 49 14.5	4 38 06.79	2,22	Aldebaran	2,22	6 52 30.65	19 03.8	13 28.54	098		35	ENE Ditto	Ditto	
20th	2 31 17	1 54 03.56	1,97	$\alpha$ Arietis	1,97	6 52 26.65	19 19.8	13 12.54	29,674		26.3	North Ditto	Ditto	
21st	2 27 20	1 50 06.77	1,97	Ditto	1,97	6 52 26.44	19 20.8	13 11.54	800		26.8	Ditto Fresh	Clear	Aurora faint SW.
22d	2 23 23	1 46 09.38	1,97	Ditto	1,97	6 52 26.81	19 19.2	13 13.14	837		27.2	Ditto	Ditto	Ditto. [ward.
23d	2 19 26	1 42 13.26	1,97	Ditto	1,97	6 52 25.93	19 22.3	13 10.04	810		32	SW Light	Clear	Do. bright to the south-
26th	2 07 30	1 30 21.96	0,73	Ditto	0,73	6 52 21.55	19 42.2	12 50.14	987		26.5	Calm	Very Clear	Do. faint in SW.
29th	1 55 35	1 18 31.43	0,73	Ditto	0,73	6 52 16.66	20 00.7	12 31.64	666		16	.....	A little haze near horizon,	Ditto
1825.														Star quite distinct.
Jan. 2d	1 39 42	1 02 32.13	3,25	Ditto	3,25	6 52 22.93	19 32.3	13 00.04	847		30	Ditto	A few thin clouds	Ditto
3d	1 35 49	0 58 33.8	3,25	Ditto	3,25	6 52 28.24	19 10.3	13 21.73	828		33	Ditto	Ditto	Ditto
5th	1 27 49.3	0 50 38.56	3,25	Ditto	3,25	6 52 23.55	19 29.8	13 02.54	356		35.5	Ditto	A little haze	Ditto
6th	1 23 49	0 46 40.86	3,25	Ditto	3,25	6 52 20.91	19 44.4	12 47.94	322		32.2	NE	Ditto Eastward	Ditto
10th	1 08 06.2	0 30 50.28	2,11	Ditto	2,11	6 52 28.60	19 07.5	13 24.84	30,054		35.5	Easterly Ditto	Very Clear	Ditto
11th	1 04 12.2	0 26 51.01	2,11	Ditto	2,11	6 52 33.89	18 45	13 47.34	127		39.3	Ditto	Ditto	Ditto
12th	1 00 09	0 22 52.86	2,11	Ditto	2,11	6 52 28	19 06.3	13 26.04	29,983		38.7	Ditto	Ditto	Ditto
17th	0 40 17	0 02 59.46	2,5	Ditto	2,5	6 52 30.09	19 00.2	13 32.14	623		26.5	Ditto Fresh	Clear over head	Drift below, star distinct.
20th	12 28 05.5	11 50 56.47	2,3	Ditto	2,3	6 52 21.70	19 35	12 57.34	372		29	Northerly Light	Very Clear	Aurora faint to south-
25th	11 24 49.5	10 47 33.32	6,02	Ditto	6,02	6 52 28.81	19 04.5	13 27.84	787		43.2	Easterly Ditto	A few Clouds	Star very distinct. [ward.
27th	11 16 45.5	10 39 30.03	6,02	Ditto	6,02	6 52 28.05	19 06.7	13 25.64	833		28.2	NW Fresh	Very Clear	
Feb. 2d	10 50 34.5	10 13 14.08	5,91	Ditto	5,91	6 52 32.94	18 46	13 46.34	224		41.2	Easterly Mod.	Ditto	
7th	10 30 10	9 53 03.44	5,7	Ditto	5,7	6 52 18.59	19 45.5	12 46.84	583		26.5	Calm	Ditto	Twilight westward.
8th	10 26 24	7 51 21.35	5,7	$\alpha$ Andromedæ	5,7	6 52 35.89	18 32.8	13 59.54	749		37	Ditto	Ditto	Ditto
9th	10 22 17.8	9 45 00.75	5,7	$\alpha$ Arietis	5,7	6 52 28.77	19 02.5	13 29.84	960		37.7	Easterly Light	Ditto	Ditto
11th	10 14 16.7	7 39 19.13	5,7	$\alpha$ Andromedæ	5,7	6 52 30.71	18 54.3	13 38.04	30,154		34			
Means 13 12,51 29,761										-29,94				

Table V.

Observations for determining the Apparent Altitude of  $\alpha$  Aquilæ at setting, by Captain PARRY's lower telescope.

The corresponding observations for Refractions are contained in Table VI.

Day.	Time.	No. of Observations.	Mean Reading of the 4 Verniers.	Correction for		Apparent Altitude.	Barom. Corr. to Temp. + 50°.	Tem. Fahr.	Winds True.	Weather.	Remarks.
				Index.	Level.						
1825.	h. h.						Inches.	°			
Feb. 16th	1 to 2 P.M.	8	322 48 33,75	+10	—10,25	4 38 55,81	29,831	—36	Easterly	Fine	☉ had been on the board just before the observation.
	2 to 3 P.M.	8	285 37 12,5	*	—16,25	57,19	29,831	—34½	Easterly		
18th	8 to 9 A.M.	8	322 48 00	+2,5	+29,25	56,03	29,608	—29	Easterly	Clear	☉ not up.
	2½ to 4 P.M.	8	285 35 12,5	*	+1'24,25	55,41	29,645	—26½	Easterly	Ditto	☉ had set.
22d	8 to 9 A.M.	8	322 48 12,5	+10	—12,25	58,72	29,791	—30	ESE	Ditto	☉ not on the board.
Mean altitude by repeating circle ....						4 38 56,63	See Tab. III.				
Ditto for upper telescope....						4 32 32,34					
Difference of the two telescopes by zenith distances						6' 24",29					

Observations by the micrometer, to obtain the angular distance between the two telescopes used for observing the setting of  $\alpha$  Aquilæ. The telescope placed on the board as before described.

March 12th, 1825.

From 10<sup>h</sup> 30<sup>m</sup> to 11<sup>h</sup> 30<sup>m</sup> A. M.

Upper wire fixed.	Lower wire moved.
61,2	45,8
58,8	50,6
59,2	53
60,2	46,3
60,9	48,8
62,3	51
60	49
62	49,4
61	49,3
63	49,3
60,86	49,25
49,25	
11,61	

From Noon till 1<sup>h</sup> 0<sup>m</sup> P. M.

Upper wire fixed.	Lower wire moved.
32	43
32,5	44
31,5	43,2
33,2	43,8
32,3	48
33,8	43
32,8	43,8
36,8	45
36,2	47
37	47,5
33,81	44,83
	33,81
	11,02

$$\begin{aligned}
 &11,61 + 8 \text{ turns of the screw} = 811,61 \text{ divisions.} \\
 &811,02 = + 8 \text{ turns} \quad 11,02 \\
 &\text{Mean } 811,31 \times 47' 7'' \text{ (the value of each division)} = 6' 27'',09.
 \end{aligned}$$

Difference of altitude between the two telescopes by the repeating circle.....6' 24",29  
by the micrometer.....6 27 ,09

Mean .....6 25 ,69  
Altitude observed for the upper telescope (Table III.) .....4 32 32 ,34

Altitude for lower telescope, used for the refractions, in Table VI.....4 38 58 ,03

Table VI.

Observations for the Atmospheric Refraction, observed by the setting of  $\alpha$  Aquilæ, 1824-5, by Captain PARRY.Apparent Altitude  $4^{\circ} 38' 58''.03$ .

Day.	Time of $\alpha$ Aquilæ setting by No. 2.		Transit observed.		Rate of No. 2 losing.	$\alpha$ Aquilæ.			Observed Refraction.	Barom. Corr. to Temp. + 50°.	Temp. Fahr.	Winds True.	Weather.	Remarks.
	h.	m.	s.	h.	m.	s.	Hor. $\angle$ at setting.	True altitude.						
1824.														
Dec. 20th	2	29	43.5	1	54	03.56	6 50 52.89	4 25 52.3	13 05.73	Inches. 29.674	—26.3	North Light	Very clear	Aurora faint.
21st	2	25	46	1	50	06.77	6 50 52.17	25 55.4	13 02.63	800	26.8	Do. Fresh	Do.	Do. bright to southward.
22d	2	21	47	1	46	09.38	6 50 50.54	26 01.8	12 56.23	837	27.2	SW Light	Do.	Do. faint in SW.
23d	2	17	50.5	1	42	13.26	6 50 50.16	26 04.4	12 53.63	810	32	Calm	Do.	Do.
26th	2	05	55.5	1	30	21.96	6 50 46.39	26 19	12 39.03	987	26.5	.....	Clear, except near the horizon.	Do.
29th	1	54	00	1	18	31.43	6 50 41.39	26 39.4	12 18.63	666	16	Easterly Light	Do. a thin haze near horizon.	Do.
1825														
Jan. 2d	1	38	08	1	02	32.13	6 50 48.66	26 07	12 51.03	847	30	Do.	Do.	Moonlight.
3d	1	34	11	0	58	33.8	6 50 49.94	26 01.5	12 56.53	828	33	Do.	Do. a few thin clouds; star distinct.	Do.
5th	1	26	16.3	0	50	38.56	6 50 50.19	26 00.3	12 57.73	356	35.5	Do.	Do. a little haze	Do.
6th	1	22	17	0	46	40.86	6 50 48.66	26 06.4	12 51.63	322	32.2	NE	Do.	Do.
10th	1	06	33	0	30	50.28	6 50 55.15	25 38.6	13 19.43	30,054	35.5	Easterly	Do.	Do.
11th	1	02	36.5	0	26	51.01	6 50 57.93	25 33.3	13 24.73	127	39.3	Do.	Do.	Do.
12th	0	58	37	0	22	52.86	6 50 56.55	25 35	13 22.03	29,983	38.7	Do.	Do.	Do.
15th	0	46	38	0	11	00.16	6 50 50.18	25 58.4	12 59.63	735	28	Do.	Do.	[star not very clear.
16th	0	42	18	0	06	59.86	6 50 50.42	25 57.7	13 00.33	758	32.8	Do.	Do.	Aurora to the southward at times,
17th	0	38	39	0	02	59.46	6 50 51.82	25 51.9	13 06.13	623	26.5	Do. Fresh	Clear	Aurora faint to southward.
20th	12	26	29.5	11	50	56.47	6 50 44.44	26 22.9	12 35.13	372	29	North Light	Do.	Some drift.
25th	11	23	14.5	10	47	33.32	6 50 53.54	25 43.6	13 14.43	787	43.2	Easterly	Do.	Aurora faint to southward.
27th	11	15	11	10	39	30.03	6 50 52.99	25 45.3	13 12.73	833	28.2	NW Fresh	Do.	Some twilight.
Feb. 2d	10	48	58.2	10	13	14.08	6 50 56.38	25 32.3	13 25.73	30,224	41.2	Easterly mod.	Do.	Good
7th	10	28	33.5	9	53	03.44	6 50 41.92	26 30.3	13 27.73	29,583	26.5	Calm	Do.	Do.
8th	10	24	44.6	7	51	21.35	6 50 56.21	25 32.2	13 25.83	749	37	Do.	Do.	Do.
9th	10	20	42	9	45	00.75	6 50 52.71	25 46.8	13 11.23	960	37.7	Easterly Light	Do.	Do.
11th	10	12	44.2	7	39	19.13	6 50 57.94	25 22.6	13 35.43	30,154	34	Do.	Do.	Do.
Means 13 4.72 29,795											—31.8			

*Observations to determine the amount of*

Table VII.

Observations for determining the apparent Altitude of Arcturus at the time of setting, by  
Lieutenant FOSTER's *upper* telescope.

The corresponding Observations for Refraction are contained in Tables VIII. and IX.

1825. Day.	Time.	No. of Obs.	Mean Reading of the four Verniers.	Correction for		Apparent Altitude.	Barom. at Temp. + 48°.	Tem. Fah°.	Winds. True.	Weather.	Remarks.
				Index.	Level.						
Feb. 18th	h. At 10 A. M.	16	238 34 17,5	+10,0	+17,75	7 35 19,67	Inches. 29,540	—26	ESE Lt.	Fine & clear	Thin haze near the hor <sup>n</sup> . Hazy near the horizon.
—*19th	11 A. M.	12	147 31 2,5	—	+6,75	7 35 15,69	29,610	—29	Easterly	Hazy, with slight snow	
— 20th	10 A. M.	12	56 28 2,5	—	+4,5	7 35 14,63	29,626	—35	Calm	Clear & fine	
— 21st	9 A. M.	6	190 55 57,5	—	+5,0	7 35 20,00	.....	—40	Calm	Fine weather	
	to 1½ P. M.	6	325 23 57,5	—	+1,0	7 35 18,83	29,460	—	.....	.....	
Mar. 4th	10 A. M.	16	238 34 10,25	0,0	+14,50	7 35 20,95	29,600	—31	Calm	Clear & fine	

Mean 7° 35' 18,32 being the altitude used in Table VIII.

† Micrometrical measure of ∠ between tel. +1 49,82

Apparent altitude of Arcturus at setting by the *lower* tel. 7 37 8,14 being the altitude used in Table IX.

• N. B. The Index was never reset to zero after the observations of the 18th; but the instrument was carefully secured from the weather, without disturbing the verniers, and the succeeding days observations commenced at that part of the arc where the preceding ones left off. The reading, however, of all the verniers was always taken before the commencement of a fresh series of zenith distances; and as no difference in the results of the two days' readings was found, this notice will suffice for all the following observations on the altitude of this board, except that on March 4th, when the principal vernier was set to zero.

† N. B. This measurement between the upper and lower telescopes was obtained after the manner already described, by means of a double wire micrometer attached to one of DOLLOND's achromatic telescopes of 46 inches focal length, and 3¼ inches aperture. The number and parts of a revolution being in this case 2<sup>rev.</sup> 30<sup>div.</sup> 8. The value of a revolution, as determined from a series of observations on stars, is 47",7, from which we deduce 1' 50",09 for the angle subtended at the board between the upper and the lower telescopes. But the focal length of the telescope in this measurement being 46,11 in consequence of the distance, instead of 46 inches; the angle thus measured must be reduced in the ratio of these two focal lengths in order to obtain 1' 49",82, the correct angular distance between the telescopes.



Table VIII.

Observations for the Atmospheric Refraction observed by the setting of Arcturus, 1824 and 1825. Apparent Altitude 7° 35' 18" 43.  
By Lieutenant FOSTER.

Day.	Time of Arcturus setting by No. 423.	Transit observed.		Rate of 423.	Arcturus.			Observed Refrac-tion.	Barom. <sup>r</sup> at Temp. +48°.	Temp. Fahr.	Winds (true).	Weather.	Remarks.
		Star.	Time by 423.		h. m. s.	h. m. s.	h. m. s.						
1824.													
Nov. 28th	h. m. s.	$\alpha$ Andromeda	13 36 52,58	+ 2,8	9 9 20,93	7 27 09,62	8 8,81	29,936	Inches.	— 5	Easterly Fresh	Fine & clear	
Dec. 1st	12 54 38	$\alpha$ Arietis	15 22 52,54	+ 17,2	9 9 24,33	7 26 59,34	8 19,09	30,083		— 20	North Light	Hazy	
2d	12 39 02	Ditto	15 18 58,34	+ 2,83	9 9 24,12	7 26 58,21	8 20,22	29,946		— 21	North Light	Hazy	
4th	12 31 7,5	Ditto	15 11 15,53	+ 4,0	9 9 19,50	7 27 11,94	8 6,49	29,625		— 21,8	Easterly	Hazy near the horizon; clear over head.	
5th	12 27 41	$\alpha$ Andromeda	13 9 43,56	+ 3,94	9 9 32,76	7 26 34,84	8 43,59	29,949		— 21	Easterly	Very clear	
6th	12 23 44	Ditto	13 5 50,51	+ 3,9	9 9 28,77	7 26 45,65	8 32,78	29,775		— 18,8	NE Fresh	Sky clear; star twinkled much some time before setting.	
7th	12 19 45	Ditto	13 1 58,45	+ 3,9	9 9 21,77	7 27 04,89	8 13,54	29,522		— 11	NE Fresh	A few fleecy clouds; star clear, did not twinkle this evening.	
8th	12 15 55	Ditto	12 58 06,65	+ 3,6	9 9 23,53	7 26 59,68	8 18,75	29,501		— 19,5	NE Light	Sky clear and fine.	
9th	12 12 06	Ditto	12 54 14,86	+ 4,23	9 9 26,31	7 26 51,70	8 26,73	29,725		— 18,5	Calm still	Clear event	
13th	12 10 50,50	Ditto	12 52 54,70	+ 4,0	9 9 30,92	7 26 37,90	8 40,53	30,001		— 24,5	North moder.	Sky clear	
	Time by 649.			Rate, 649.									
14th	12 6 58	Ditto	12 49 04,7	+ 6,4	9 9 28,35	7 26 44,78	8 33,65	30,152		— 27,2	WNW		
15th	12 3 10,5	Ditto	12 45 13,63	+ 5,4	9 9 31,84	7 26 34,51	8 43,92	30,336		— 35	NE Light		
21st	11 40 05	Ditto	12 22 08,75	+ 6,2	9 9 31,01	7 26 35,60	8 42,83	29,806		— 28,2	North		Star bright at setting; Aurora faint S. W.
22d	11 36 12,2	Ditto	12 18 16,96	+ 4,4	9 9 29,90	7 26 38,44	8 39,99	29,877		— 29	East	Fine & clear	Aurora faint in the S. W.
23d	11 32 21	Ditto	12 14 25,46	+ 4,2	9 9 30,15	7 26 37,47	8 40,96	29,802		— 31	NE	Sky clear	Aurora faint in the S. W.
25th	11 24 33,5	Ditto	12 6 40,75	0,0	9 9 27,13	7 26 45,36	8 32,07	29,886		— 25,2	Calm	Clear	Aurora faint in the SE. by S.
26th	11 20 41,5	Ditto	12 2 50,33	+ 5,2	9 9 25,68	7 26 49,10	8 29,93	29,983		— 27,8	ENE moderate	Sky clear	Star twinkled a little before setting;
28th	11 12 52	Ditto	11 55 7,36	+ 1,3	9 9 18,92	7 27 7,45	8 10,58	29,517		— 12,5	East Fresh	Sky clear	[Aurora faint SSW.
29th	11 9 35,0	Ditto	11 51 15,45	+ 2,8	9 9 22,34	7 26 57,60	8 20,83	29,638		— 16,5	Light	Fine & clear	Star quite bright at the time of observation.
1825.													
Jan. 2d	10 53 44	Ditto	11 35 51,95	+ 5,0	9 9 26,20	7 26 45,18	8 33,25	29,881		— 29,4		Clear to the westward, hazy in the eastern quar.	
3d	10 49 51,50	$\alpha$ Arietis	13 29 41,00	0,0	9 9 23,68	7 26 52,06	8 26,37	29,835		— 31,5		Sky clear, with long streaming white clouds.	
4th	10 46 00,80	$\alpha$ Andromeda	11 28 9,42	+ 3,8	9 9 25,4	7 26 37,37	8 41,06	29,486		— 27,2	ENE Fresh	Sky hazy. A halo round the moon, diameter measuring 23° 29'.	
5th	10 42 15,50	Ditto	11 24 17,63	+ 4,3	9 9 31,88	7 26 28,74	8 49,69	29,336		— 36,5	Easterly Light	Clear over head and to the westward; thin slight haze to the [eastward.	
7th	10 34 26,00	Ditto	11 16 34,10	+ 4,0	9 9 25,80	7 26 45,15	8 33,28	29,509		— 35,5	Calm still	Clear event	
10th	10 22 59,50	Ditto	11 5 2,93	+ 5,6	9 9 30,39	7 26 31,73	8 46,70	29,961		— 35,5	Easterly Light	Sky clear	Aurora faint to the SSW.
11th	10 19 10,00	Ditto	11 1 11,25	+ 4,0	9 9 32,56	7 26 25,33	8 53,10	30,140		— 38,3			
12th	10 15 20,50	Ditto	10 57 20,23	+ 4,9	9 9 34,29	7 26 20,50	8 57,93	29,953		— 38,5			
15th	10 03 43,50	Ditto	10 45 45,85	+ 4,5	9 9 31,21	7 26 28,53	8 49,90	29,711		— 27,5			
16th	9 59 49,00	Ditto	10 41 55,78	+ 6,2	9 9 26,78	7 26 41,04	8 37,79	29,730		— 31,5	moderate		
17th	9 55 58,00	Ditto	10 38 4,91	+ 5,07	9 9 26,58	7 26 40,00	8 37,43	29,638		— 28		Slight hazy	
20th	9 44 21,00	$\alpha$ Pegasi	9 23 24,07	+ 5,4	9 9 21,55	7 26 54,42	8 24,01	29,409		— 26,2	NE Light	Sky clear	
22d	9 36 35,00	$\alpha$ Andromeda	10 18 51,20	+ 5,84	9 9 16,77	7 27 7,39	8 11,04	29,341		— 25,5	NNE Fresh	Sky hazy, through which the star was indistinctly seen at setting.	
24th	9 29 12,00	$\alpha$ Pegasi	9 15 43,05	+ 3,87	9 9 35,02	7 26 16,21	9 2,22	29,820		— 37,2	Light	Sky clear, except a few light clouds to the eastward, and low down southward.	
25th	9 15 15,00	$\alpha$ Pegasi	9 8 2,18	+ 5,5	9 9 27,98	7 26 35,77	8 42,66	29,795		— 42,2		Sky clear	
27th	9 17 28,50	Ditto	8 56 30,00	+ 6,2	9 9 22,85	7 26 49,70	8 28,73	29,847		— 27	NWb N Fresh		Star bright and clear at setting.
Feb. 2d	8 54 25,50	$\alpha$ Andromeda	9 36 29,55	+ 3,84	9 9 28,74	7 26 32,54	8 45,89	30,139		— 40,9	East moderate		
10th	8 23 26,50	Ditto	9 05 32,53	+ 4,00	9 9 26,47	7 26 38,02	8 40,41	30,211		— 37	Calm		
Means										— 27,3			



Table X.

Observations for determining the Apparent Altitude of  $\alpha$  Aquilæ at the time of setting, by Lieutenant FOSTER's *upper* telescope.

The corresponding Observations for Refraction are contained in Tables XI. and XII.

Day.	Time.	No. of Observations.	Mean reading of four Verniers.	Correction for		Apparent zenith distance.	Apparent altitude deduced from the apparent zenith distance by the ratio of the No. of observations.	Barom <sup>r</sup> . at Temp. + 48°.	Temp. Fah <sup>t</sup> .	Winds True.	Remarks.
				Index	Level.						
1825.	h. m.							Inches.	°		
Jan. 28th	At 11 A. M.	8	323 7 57,5	0,0	+1,0	85 23 29,81	} 4 36 25,97	29,970	— 29,5	.....	Occasion-ally squally
—	1 30 P. M.	14	* 78 38 30,0	—	+8,25	85 23 37,20					
Feb. 7th	— 11 A. M.	8	323 8 20,0	0,0	—0,5	85 23 32,44	} 4 36 22,17	29,455	— 22,5	North mod.	Fine
—	2 P. M.	8	*286 18 5,0	—	+0,75	85 23 43,22					
9th	— 10 A. M.	8	323 8 1,25	0,0	+3,0	85 23 30,53	} 4 36 21,67	29,701	— 35,7	Calm Fine & clear	
—	1 P. M.	14	*115 32 16,25	—	+2,25	85 23 44,18					
— 10th	— 10 30 A. M.	6	*152 21 51,25	—	+3,25	85 23 39,08	} 4 36 21,46	30,100	— 35,5	Calm	
—	1 30 P. M.	6	*304 43 41,25	—	—2,0	85 23 38,00					
— 15th	— 11 A. M.	12	*304 43 8,75	—	+2,50	85 23 35,94	} 4 36 24,06	29,600	— 33	Cloudy, overcast weather.	Clear & fine
— 28th	— 11 A. M.	6	*152 22 1,25	—	—3,50	85 23 39,62					
—	1 30 P. M.	6	*304 43 25,00	—	+1,00	85 23 34,12	} 4 36 23,13	29,992	— 21	NE Light	

Mean = the apparent altitude, *upper* telescope 4 36 13,08, being the altitude used in Table XI.

† Micrometrical measure of  $\angle$  subtended at the board between the telescopes = + 3 8,42

Apparent altitude for the *lower* telescope 4 39 31,50, being the altitude used in Table XII.

• The principal vernier not reset to zero, and the observations are continued from the preceding reading.

† The number and parts of a revolution in this case being  $3^{\text{revs}} 96^{\text{divs}} 7$ , we obtain  $3' 9'', 22$  for the angular distance between the telescopes used in the observations on refractions. The focal length, however, of the telescope to which the micrometer was attached being in the present case 46,19, instead of 46 as before stated, and the above angular distance being reduced in the ratio of 46,19 to 46, we have  $3' 8'', 42$  for the correct angle subtended by the distance between the upper and lower telescopes.

Table XI.

Observations for the Atmospheric Refraction, observed by the setting of  $\alpha$  Aquilæ, 1824 and 1825. Apparent Altitude  $4^{\circ} 36' 32'' .08$ .  
By Lieutenant FOSTER.

Day.	Time of $\alpha$ Aquilæ setting by No. 423.	Transit Observed.		$\alpha$ Aquilæ.		Observed Refraction.	Barom. at Temp. $+48^{\circ}$ , Inches.	Temp. Fahr.	Winds (true.)	Weather.	Remarks.
		Star.	Time by No. 423.	Rate of 423.	Hourly $\angle$ at setting.	True Altitude.					
1824. Dec 8th	h. m. s. 3 31 58 Time by 649	$\alpha$ Arictes.	h. m. s. 2 55 46,28 Time by 649	s. +3.6 Rate 649	h. m. s. 6 51 24,69	0 1 22 58,87	13 24,21	29,544	—18	NNE Squally Sky Clear	
11th	3 34 26	Ditto	2 58 10,40	+4.9	6 51 32,55	4 23 07,45	13 15,63	29,708	—14	NNW Fresh Clear and Fine	
13th	3 26 59,50	Ditto	2 50 34,03	+4.0	6 51 38,45	4 22 42,51	13 40,57	30,057	—25	North Light Ditto	Star indistinctly seen at setting.
14th	3 23 03	Ditto	2 46 45,13	+6.4	6 51 30,77	4 23 14,99	13 08,09	30,190	—18,5	West Ditto Sky Clear	Aurora faint to the SW. Some streamers.
16th	3 15 24	Aldebaran	5 07 12,99	+5.7	6 51 34,38	4 22 59,17	13 23,91	30,098	—35	ENE Ditto Ditto	Aurora faint to the SW. [NW.]
20th	2 59 58	$\alpha$ Arictis	2 23 38,26	+5.0	6 51 32,65	4 23 05,73	13 17,35	29,666	—26,3	North Ditto SW Fresh	Clear still evenf.
21st	2 56 02,20	Ditto	2 19 48,27	+6.2	6 51 26,79	4 23 32,61	12 50,47	29,794	—26,8	SW Light Calm	Sky Clear & fine Aurora faint to the SW.
22d	2 52 15	Ditto	2 15 56,88	+4.4	6 51 25,04	4 23 37,40	12 45,68	29,844	—27,2	NNE Light Calm	Fine Clear evenf.
23d	2 48 24,50	Ditto	2 12 47,76	+4.2	6 51 26,66	4 23 30,48	12 52,60	29,810	—32	ENE Moderate Sky Clear	Aurora faint to the westward.
25th	2 40 32,00	Ditto	2 4 20,26	+0.0	6 51 24,71	4 23 38,35	12 44,73	29,929	—26	ENE Moderate Sky Clear	thin high clouds near the horizon, through which the star was faintly seen at setting.
26th	2 36 43	Ditto	2 00 29,36	+5.2	6 51 26,46	4 23 30,87	12 52,21	29,988	—26,5	ENE Moderate Sky Clear	thin high clouds near the horizon, through which the star was faintly seen at setting.
29th 1825. Jan. 1st	2 25 01	Ditto	1 48 55,13	+4.1	6 51 18,67	4 24 03,14	12 19,94	29,666	—16	Eastward Light Fine and Clear	Thin haze near the horizon, but through which, the stars were distinctly seen.
2d	2 13 36,50	$\alpha$ Ceti	2 33 03,82	+5.2	6 51 25,34	4 23 33,73	12 49,35	29,836	—26	Ditto Ditto	Sky Clear Star bright at setting.
3d	2 9 48,40	$\alpha$ Arictis	1 33 32,33	+4.6	6 51 28,78	4 23 19,03	13 04,05	29,847	—30	Ditto Ditto	Thin white clouds to the SW. Star set very bright.
5th	2 5 56,50	Ditto	1 29 41,00	—2.9	6 51 28,28	4 23 21,04	13 02,04	29,828	—33	Ditto Ditto	Sky Clear Star bright at setting. [parts.]
6th	1 57 17,50	Ditto	1 21 56,76	+4.3	6 51 28,71	4 23 18,93	13 04,15	29,356	—35,5	North Ditto	Thin haze to the eastward, perfectly clear in other
10th	1 39 2,00	Ditto	1 18 5,36	+4.5	6 51 24,81	4 23 35,10	12 47,98	29,322	—32,2	Eastward Light Ditto	Hazy Clear
11th	1 35 16,00	Ditto	1 2 42,78	+5.6	6 51 32,77	4 23 01,21	13 21,87	30,050	—35,5	Ditto Ditto	Sky Clear Ditto
12th	1 31 21,00	Ditto	0 58 50,31	+4.0	6 51 38,27	4 22 38,03	13 45,05	30 125	—39,3	Ditto Ditto	Sky Clear Ditto
15th	1 19 42,80	Ditto	0 54 59,36	+4.9	6 51 34,16	4 22 55,11	13 27,97	29,984	—38,7	Ditto Ditto	Sky Clear Ditto
16th	1 15 53,80	Ditto	0 43 25,66	+4.5	6 51 28,60	4 23 18,14	13 04,94	29,732	—28	Ditto Ditto	Clear and Fine Ditto
17th	1 12 03,20	Ditto	0 39 36,36	+6.2	6 51 29,82	4 23 12,70	13 10,38	29,754	—32,8	Ditto Ditto	Sky Clear Ditto
18th	1 08 06,80	Ditto	0 35 45,56	+5.07	6 51 30,03	4 23 11,67	13 11,41	29,622	—26,5	Ditto Ditto	Sky Clear Ditto
20th	1 00 24,50	Ditto	0 31 53,48	+4.1	6 51 25,71	4 23 29,38	12 53,70	29,561	—23	NE Strong Ditto	Sky Clear Ditto
25th	0 41 22,50	Ditto	0 24 12,47	+5.4	6 51 27,34	4 23 22,51	13 00,57	29,372	—29	North Light Easterly Ditto	Ditto Ditto
27th	0 33 44,50	Ditto	0 05 00,32	+5.5	6 51 34,37	4 22 52,36	13 30,72	29,787	—43,2	North Light Ditto	Ditto Ditto
Feb. 2d	12 10 35,00	Ditto	11 57 19,53	+6.2	6 51 37,12	4 22 40,56	13 42,52	29,836	—28	East Light Ditto	Ditto Ditto
4th	12 02 36,50	$\alpha$ Arictis	11 26 23,40	+3.84	6 51 36,92	4 22 40,58	13 42,50	30,229	—41,5	ENE Strong and squally, sky clear over head, but the star bright at setting.	Star bright at setting.
7th	11 59 59,50	$\alpha$ Ceti	12 22 03,68	+2.91	6 51 24,91	4 23 30,61	12 52,47	30,056	—19,5	ENE Strong and squally, sky clear over head, but the star bright at setting.	Star bright at setting.
8th	11 47 21,80	$\alpha$ Androm.	12 10 28,17	+4.1	6 51 23,22	4 23 37,31	12 45,77	29,583	—26,5	Calm, Clear and very fine.	Faint twilight to the westward.
9th	11 43 25,20	$\alpha$ Arictis	12 06 36,50	+4.33	6 51 37,05	4 22 39,29	13 43,79	29,745	—37	Calm Clear still evening.	
Means				+4.4	6 51 32,11	4 22 59,85	13 23,23	29,959	—37,6	Eastward Light Sky perfectly clear.	

Table XII.

Observations for the Atmospheric Refraction, observed by the setting of  $\alpha$  Aquilæ, 1824 and 1825. Apparent Altitude  $4^{\circ} 39' 31'' .50$ .  
By Lieutenant FOSTER.

Days.	Time of $\alpha$ Aquilæ setting by No. 649.	Transit observed.		Rate of 649.	$\alpha$ Aquilæ.		Observed Refraction.	Barom. at Temp. $+48^{\circ}$ .	Temp. Fahr.	Winds (true).	Weather.	Remarks, &c.
		Star.	Time by 649.		Hor. $\angle$ at setting.	True altitude.						
1824.												
Dec. 20th	h. m. s.	$\alpha$ Arietis	2 23 38.26	S. $+5.0$	h. m. s.	o' "	Inches.					
21st	2 55 15	Ditto	2 19 48.27	$+6.2$	6 50 45.52	4 26 23.13	29.666			Clear still evening	Sky clear	Aurora faint to the SW.
25th	2 39 49.5	Ditto	2 4 20.26	0.0	6 50 39.49	4 26 48.2	29.794			North Fresh		Aurora bright to the SW.
29th	2 24 16	Ditto	1 48 55.13	$+4.1$	6 50 42.09	4 26 36.69	29.929			NNE Light		Aurora faint to the westward.
1825.										Eastward ....	Fine & clear	{ Thin haze near the horizon, through which the stars were distinctly seen.
Jan. 1st	2 12 51.5	$\alpha$ Ceti	2 33 03.82	$+5.2$	6 50 40.22	4 26 42.82	29.836				Sky clear	Star bright at setting.
2d	2 09 00	$\alpha$ Arietis	1 33 32.33	$+4.6$	6 50 40.25	4 26 42.7	29.847				Thin white clouds to the SW; star set very bright.	
3d	2 05 09	Ditto	1 29 41.00	$-2.9$	6 50 40.65	4 26 40.55	29.828			moderate	Sky clear; star bright at setting.	
5th	1 57 26	Ditto	1 21 56.76	$+4.3$	6 50 41.78	4 26 35.74	29.356			Light	Thin haze to the eastward, perfectly clear in other parts.	
6th	1 53 33.5	Ditto	1 18 05.36	$+4.55$	6 50 40.69	4 26 39.01	29.322			North ....	Hazy	Star distinctly seen at setting.
10th	1 38 19	Ditto	1 02 42.78	$+5.6$	6 50 49.65	4 26 01.8	29.050			Easterly ....	Clear	Aurora faint to the SSW.
11th	1 34 29.7	Ditto	0 58 50.31	$+4.0$	6 50 51.84	4 25 52.11	30.125					Star bright.
12th	1 30 35	Ditto	0 54 59.36	$+4.9$	6 50 48.03	4 26 8.35	29.984					
15th	1 18 58.5	Ditto	0 43 25.66	$+4.5$	6 50 44.18	4 26 23.96	29.732				Clear & fine	{ Aurora faint to the southward, star somewhat obscured at setting.
16th	1 15 07.5	Ditto	0 39 36.36	$+6.2$	6 50 42.39	4 26 31.35	29.754			moderate	Sky clear	{ Stars bright; Aurora faint in the SW near horizon.
17th	1 11 16.8	Ditto	0 35 45.56	$+5.97$	6 50 43.50	4 26 30.25	29.622			.... Fresh	Somewhat hazy	{ Aurora faint near horizon to the WSW.
20th	0 59 39.5	Ditto	0 24 12.47	$+5.4$	6 50 42.22	4 26 31.6	29.372			Northw. light	Sky clear	{ Aurora faint near horizon to the southward.
25th	0 40 38.4	Ditto	0 05 00.32	$+5.5$	6 50 50.15	4 25 57.55	29.787			Easterly ....		{ A few thin clouds to the southward about the moon.
27th	0 32 54.2	Ditto	11 57 19.53	$+6.2$	6 50 46.68	4 26 11.79	29.836			NW Fresh		{ Star bright at setting.
Feb. 2d	12 09 47.8	Ditto	11 34 10.08	$+3.84$	6 50 49.59	4 25 58.75	30.229			Easterly Light		
4th	12 01 53.5	$\alpha$ Arietis	11 26 23.4	$+2.91$	6 50 41.79	4 26 31.22	30.056			{ ENE strong and squally. Sky clear over head, considerable drift; star bright at setting.		
		$\alpha$ Ceti	12 22 3.68									
7th	11 50 10.9	$\alpha$ Arietis	11 14 47.94	$+4.1$	6 50 34.49	4 27 01.45	29.583			Calm, clear and very fine; faint twilight to the westward.		
		$\alpha$ Ceti	12 10 28.17									
8th	11 46 32.8	$\alpha$ Andromeda	9 13 16.55	$+4.33$	6 50 47.92	4 26 05.03	29.745			Calm, clear still evening.		
		$\alpha$ Ceti	12 6 36.5									
9th	11 42 40.2	$\alpha$ Arietis	11 7 04.25	$+4.41$	6 50 46.99	4 26 8.81	29.959			Eastward Light; sky perfectly clear.		
		$\alpha$ Ceti	12 2 44.95									
Means										13. 4.73	29.742	-31.1

Table XIII.

Observations for the Atmospheric Refraction observed by the setting of Arcturus, 1824-25. Apparent Altitude  $7^{\circ} 38' 0'' 52$ .  
By Lieutenant Ross.

Date.	Time of Arcturus setting reduced to 649.		Transit Observed.		Rate of 649 Gaining.	Arcturus's			Observed Refraction.	Barom. at Temp. + 50°.	Temp. Fahr.	Winds True.	Weather.	Remarks.
	Time by 649.		Star.			h. m. s.	o. ' "	h. m. s.						
1824.	h. m. s.	h. m. s.			s.				' "	Inches.	°			
Dec. 15th	12 02 10,8	12 45 13,63	$\alpha$ Andromedæ		5,4	9 8 31,98	7 29 21,2	8 39,51	8 39,51	30,334	—35	NE y Light	Very Clear	Aurora SW to S faint.
21st	11 38 58	12 22 8,75	Ditto		6,2	9 8 23,95	7 29 41,79	8 18,93	8 18,93	29,819	—28,2	North Ditto	Ditto	Aurora SSW faint.
26th	11 19 34	12 02 50,33	Ditto		5,22	9 8 18,01	7 29 57,17	8 3,55	8 3,55	29,984	—27,8	ENE Moderate	Ditto	
1825.														
Jan. 4th	10 44 59	11 28 9,42	Ditto		3,8	9 8 23,44	7 29 38,67	8 21,85	8 21,85	29,485	—27,2	Ditto Squally	Hazy near hori <sup>n</sup> .	Star very distinct.
5th	10 41 05,5	11 24 17,63	Ditto		4,30	9 8 21,68	7 29 43,66	8 16,86	8 16,86	29,345	—36,5	East Light	Ditto	Star clear.
6th	10 37 14,7	11 20 26,2	Ditto		4,55	9 8 22,27	7 29 41,58	8 18,94	8 18,94	29,263	—32,2	Ditto Ditto	Ditto	Ditto.
7th	10 33 23,7	11 16 34,1	Ditto		4,0	9 8 23,32	7 29 38,46	8 22,06	8 22,06	29,525	—35,5	Ditto Ditto	Very Clear	
10th	10 21 53	11 5 2,93	Ditto		5,6	9 8 23,71	7 29 36,88	8 23,64	8 23,64	29,955	—35,5	Ditto Ditto	Ditto	
11th	10 18 11	11 1 11,25	Ditto		4,0	9 8 33,32	7 29 10,19	8 50,33	8 50,33	30,136	—38,3	Ditto Ditto	Ditto	
12th	10 14 13	10 57 20,23	Ditto		4,9	9 8 26,29	7 29 29,52	8 31,0	8 31,0	29,946	—38,4	Ditto Ditto	Ditto	Faint twilight west. [horizon.
15th	10 2 34,5	10 45 45,85	Ditto		4,5	9 8 22,01	7 29 26,61	8 33,91	8 33,91	29,708	—27,5	Ditto Ditto	Ditto	Aurora faint SSW near
16th	9 58 43,5	10 41 55,78	Ditto		6,2	9 8 21,10	7 29 43,04	8 17,48	8 17,48	29,730	—31,2	East Moderate	{ Some light Clouds }	Star twinkling.
17th	9 54 52,7	10 38 4,91	Ditto		5,07	9 8 21,07	7 29 42,83	8 17,69	8 17,69	29,638	—28	Ditto Ditto		Twilight strong,
20th	9 43 16	9 23 24,07	$\alpha$ Pegasi		5,4	9 8 16,35	7 29 56,4	8 4,12	8 4,12	29,404	—26,2	North Ditto	Clear	
24th	9 28 03	10 11 9,56	$\alpha$ Andromedæ		3,87	9 8 26,46	7 29 26,61	8 33,91	8 33,91	29,822	—37,2	NE Light	Ditto	
25th	9 24 10	9 4 11,47	$\alpha$ Pegasi		5,5	9 8 22,78	7 29 36,8	8 23,72	8 23,72	29,793	—42,2	Ditto Ditto	Very Clear	
27th	9 16 26	8 56 30	Ditto		6,2	9 8 20,17	7 29 43,87	8 16,65	8 16,65	29,846	—27	NW Fresh	Clear with drift	Star clear.
Mean											8 23,18	29,749	—32,6	

Table XIV.

Observations for the Atmospheric Refraction observed by the setting of  $\alpha$  Aquilæ, 1825. Apparent Altitude  $4^{\circ} 37' 41'' .08$ .  
By Lieutenant Ross.

Date.	Time of $\alpha$ Aquilæ's setting reduced to 649.		Transit Observed.		Rate of No. 649, gaining.	$\alpha$ Aquilæ's			Observed Refraction.	Barom. at Temp. $+ 50^{\circ}$ .	Temp. Fahr.	Winds True.	Weather.	Remarks.
	h.	m.	s.	h.	m.	s.	h.	m.	s.					
1825.														
Jan.	5th	13	57	50,3	13	21	56,76	4,3		Inches.				
	6th	13	53	59,5	13	18	05,36	4,55		29,356		East Light	Clear	
	7th	13	50	09,1	13	14	13,44	4,00		29,322			Very Clear	
	10th	13	38	41,5	13	02	42,78	5,60		29,557				
	11th	13	34	53,7	12	58	50,31	4,0		30,054				
	12th	13	30	58,5	12	54	59,36	4,9		30,127				
	15th	13	19	24	12	43	25,66	4,5		30,52				
	16th	13	15	31	12	39	36,36	6,2		29,983		SW Moderate	[drift.	Star rather dim at setting.
	17th	13	11	40,3	12	35	45,56	5,07		29,623		East Fresh	Squally with snow	Hazy near the horizon.
	20th	13	00	04,8	12	24	12,47	5,40		29,372		North Light	Very Clear	zon.
Mean										13 00,42	29,689	-33,37		

Table XV.

Observations for the Atmospheric Refraction observed by the setting of  $\alpha$  Aquilæ, 1824-25. Apparent Altitude  $4^{\circ} 36' 3'' .88$ .  
By Lieutenant Ross.

Date.	Time of $\alpha$ Aquilæ's setting reduced to 649.		Transit Observed.		Rate of No. 649, gaining.	$\alpha$ Aquilæ's			Observed Refraction.	Barom. at Temp. $+ 50^{\circ}$ .	Temp. Fahr.	Winds True.	Weather.	Remarks.
	h.	m.	s.	h.	m.	s.	h.	m.	s.					
1824.														
Dec. 26th	14	36	43,7	14	00	29,36	5,2			Inches.				
29th	14	25	05,8	13	48	55,13	4,10			29,987		East Fresh	Fine Clear	Star dim at time of setting.
1825.										29,666		Ditto Light		
Jan.	5th	13	58	16,3	13	21	56,76	4,30		29,356				
	6th	13	54	24,3	13	18	05,36	4,55		29,322				
	7th	13	50	32,5	13	14	13,44	4,00		29,557				
	10th	13	39	05,2	13	02	42,78	5,60		30,054				
	11th	13	35	18	12	58	50,31	4,00		30,127				
	12th	13	31	23,5	12	54	59,36	4,90		30,52				
	15th	13	19	49	12	43	25,66	4,50		29,983				
	16th	13	15	55,5	12	39	36,36	6,2		29,737		SW Moderate		Star dim at setting.
	17th	13	12	03,8	12	35	45,56	5,07		29,623		East Fresh	Squally with snow drift.	
	20th	13	00	28	12	24	12,47	5,4		29,372		North Light	Very Clear	
Mean										12 58,85	29,712	31,35		

Table XVI.

Observations for the Atmospheric Refraction observed by the setting of  $\alpha$  Aquilæ, 1825. Apparent Altitude  $4^{\circ} 40' 38''$ .  
By Lieutenant Ross.

Date.	Time of $\alpha$ Aquilæ's setting reduced to 649.		Transit observed.		Rate of 649. Gaining.	$\alpha$ Aquilæ's			Observed Refraction.	Barometer at Temp. + 50°.	Temp. Fahr.	Winds True.	Weather.	Remarks.
	h. m. s.		Star.	Time by 649.		h. m. s.	Hourly $\angle$ at setting.	True altitude.						
1825.														
Jan. 5th	13 57 06,3	$\alpha$	Arietis	13 21 56,76	s. 4,3	6 50	22,02	4 27 57,1	12 40,9	Inches. 29,356	—35,7	East Light	Clear	[westward.
6th	13 53 15,8		Ditto	13 18 05,36	4,55	6 50	22,00	4 27 54,0	12 44	29,322	—32,2	.....	.....	Hazy, near horizon to the
7th	13 49 25,5		Ditto	13 14 13,44	4,0	6 50	24,53	4 27 47,0	12 51	29,557	—36	.....	Very clear	Aurora SW.
10th	13 37 57,5		Ditto	13 02 42,78	5,6	6 50	27,15	4 27 36,44	13 01,56	30,054	—35,5	.....	.....	.....
11th	13 34 11		Ditto	12 58 50,31	4,0	6 50	33,10	4 27 10,97	13 27,03	30,127	—39,3	.....	.....	.....
12th	13 30 13,8		Ditto	12 54 59,36	4,9	6 50	26,76	4 27 38,09	12 59,91	29,983	—38,7	.....	.....	.....
15th	13 18 39,5		Ditto	12 43 25,66	4,5	6 50	26,13	4 27 40,17	12 57,83	29,737	—28	SW moderate	.....	Star rather dim at setting.
16th	13 14 45,7		Ditto	12 39 36,36	6,2	6 50	22,53	4 27 54,2	12 43,8	29,759	—32,8	East Fresh	Clear	Squally with snow drift.
17th	13 10 56,3		Ditto	12 35 45,56	5,07	6 50	22,95	4 27 52,13	12 45,87	29,623	—26,5	North Light	Very clear	.....
20th	12 59 21,3		Ditto	12 24 12,47	5,4	6 50	20,94	4 28 00,0	12 38,0	29,372	—29	.....	.....	.....
Means										29,785	—33,37			

Table XVII.

Observations for the Atmospheric Refraction observed by the setting of  $\alpha$  Aquilæ, 1824-25. Apparent Altitude  $4^{\circ} 39' 01''$ , 8.  
By Lieutenant Ross.

Date.	Time of $\alpha$ Aquilæ's setting reduced to 649.		Transit observed.		Rate of 649. Gaining.	$\alpha$ Aquilæ's			Observed Refraction.	Barometer at Temp. + 50°.	Temp. Fahr.	Winds True.	Weather.	Remarks.
	h. m. s.		Star.	Time by 649.		h. m. s.	Hourly $\angle$ at setting.	True altitude.						
1824.														
Dec. 14th	15 22 21,2	$\alpha$	Arietis	14 46 45,13	s. 6,4	6 50	46,90	4 26 18,0	12 43,8	Inches. 30,189	—28,2	WNW Light	Clear	.....
20th	14 59 13,6		Ditto	14 23 38,26	5,0	6 50	48,12	4 26 11,6	12 50,2	29,674	—26,3	North ....	.....	.....
23d	14 47 39,5		Ditto	14 12 04,76	4,2	6 50	47,49	4 26 14,7	12 47,1	29,810	—32	Calm	.....	.....
26th	14 35 59,5		Ditto	14 00 29,36	5,2	6 50	42,83	4 26 34,35	12 26,45	29,987	—26,5	East Fresh	.....	.....
29th	14 24 20,6		Ditto	13 48 55,13	4,1	6 50	38,13	4 26 52,55	12 09,25	29,666	—16	.... Light	.....	Star dim at time of setting.
1825.														
Jan. 5th	13 57 31,5		Ditto	13 21 56,76	4,3	6 50	47,28	4 26 12,42	12 49,38	29,356	—35,7	.....	.....	.....
6th	13 53 40,3		Ditto	13 18 05,36	4,55	6 50	47,47	4 26 11,39	12 50,41	29,322	—32,2	.....	Clear overhead, hazy near horizon.	.....
7th	13 49 49,8		Ditto	13 14 13,44	4,0	6 50	48,9	4 26 05,18	12 56,62	29,557	—36	.....	Very clear	.....
10th	13 38 21		Ditto	13 02 42,78	5,6	6 50	50,71	4 25 55,86	13 05,94	30,054	—35,5	.....	.....	.....
11th	13 34 35		Ditto	12 58 50,31	4,0	6 50	57,17	4 25 30,64	13 31,16	30,127	—39,3	.....	.....	.....
12th	13 30 38		Ditto	12 54 59,36	4,9	6 50	51,03	4 25 54,82	13 06,98	29,983	—38,7	.....	.....	Star rather dim at setting.
15th	13 19 03		Ditto	12 43 25,66	4,5	6 50	49,68	4 25 59,59	13 12,21	29,737	—28	SW moderate	.....	.....
16th	13 15 11,5		Ditto	12 39 36,36	6,2	6 50	47,39	4 26 10,35	12 56,45	29,759	—32,8	East Fresh	Squally with snow drift, hazy near horiz.	.....
17th	13 11 19,5		Ditto	12 35 45,56	5,07	6 50	46,21	4 26 11,81	12 50,0	29,623	—26,5	North Light	Very clear.	.....
20th	12 59 43,8		Ditto	12 24 12,47	5,4	6 50	43,50	4 26 26,71	12 35,09	29,372	—29	.....	.....	.....
Means										29,748	—30,85			



On looking over each individual's observations, it will be seen, that great changes in the amount of atmospherical refraction took place, without any correspondent change in the state of either the barometer or thermometer; and, although the mode of observation adopted by us, is not wholly free from objection, inasmuch, as the ray of light from a bright star may suffer some degree of inflection, by passing over a sharp edge (such as the boards placed edge-wise would present, whereby their apparent altitudes would not be exactly those of the stars at the time of observation); yet we do not consider this circumstance the cause of the anomaly alluded to, for we never entertained the slightest doubt as to the moment of either of the stars' disappearance, both being always instantaneous: and, moreover, when it is recollected, that the use of instruments, proper for measuring altitudes on these occasions, in such a climate, is attended with the difficulties already described in this Paper, it will, in all probability be admitted, that this mode of observation, is at least, calculated to diminish the errors necessarily arising from the use of instruments, under such circumstances.

It is, however, with diffidence that we submit the following tabulated results of the preceding observations, for comparison with the various theories, which have from time to time been advanced by many eminent astronomers and mathematicians, to account for all the irregularities which have been noticed in the most careful observations on this important subject.

Recapitulation of the mean results, of the preceding  
Observations.

Stars Observed.	Apparent Altitude.	Barometer Corrected.	Temperat. Fahrenheit.	Observed Refraction.	No. of Obs.	Observer.
	° ' "	Inches.	°	' "		
Arcturus	7 38 0,52	29,749	—32,6	8 23,18	17	Lieut. ROSS.
	7 37 8,14	29,786	—32,0	8 35,07	21	} Lieut. FOSTER.
	7 35 18,43	29,805	—27,3	8 36,36	37	
	7 31 38,62	29,791	—23,58	8 23,95	34	Capt. PARRY.
α Aquilæ	4 40 38,0	29,785	—33,37	12 48,17	10	Lieut. ROSS.
	4 39 31,5	29,742	—31,1	13 4,73	23	Lieut. FOSTER.
	4 39 1,8	29,748	—30,85	12 51,4	15	Lieut. ROSS.
	4 38 58,03	29,795	—31,8	13 4,72	24	Capt. PARRY.
	4 37 41,08	29,689	—33,37	13 0,42	10	Lieut. ROSS.
	4 36 32,08	29,808	—29,0	13 9,37	32	Lieut. FOSTER.
	4 36 3,88	29,712	—31,35	12 58,85	12	Lieut. ROSS.
	4 32 32,34	29,761	—29,94	13 12,51	27	Capt. PARRY.

The original register of the height of the mercury in the barometer, after being corrected for instrumental errors, has been brought up to the temperature of  $+ 50^{\circ}$  of Fahrenheit, in the observations by Captain PARRY and Lieutenant ROSS, but to  $+ 48^{\circ}$  only, in the observations by Lieutenant FOSTER.

Port Bowen, July 10th, 1825.

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